A DIURNAL ROTATION IN LEAVES OF MARSILEA.

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It has long been known that the leaves of the various species of Marsilea "go to sleep" at night. The change of position at the beginning of night is very conspicuous and definite, resembling that of Oxalis and the clovers. It is caused by a bending of the petiolules which bend up at night so as to close the leaflets together thus affording protection from exposure. The occurrence of such strikingly similar movements in these three plants which have no inter-relationships nor similarities other than the accidental resemblances of their leaves is a very remarkable coincidence.

So far as the writer has found this day and night motion is the only one that has been reported for Marsilea. But in addition there are under certain conditions at least, very conspicuous changes of position in response to light stimuli, which are of considerable interest.

During the summer of 1904 the writer was engaged in some work for the United States Department of Agriculture which took him to Victoria, Texas. While located at that place he frequently had occasion to visit the government experimental farm located about a mile from the town. Very often instead of following the road he took a short cut across the fields. The land is low, swampy at times and in places is covered with *Marsilea vestita.* On these plants the observations recorded below were made. Unfortunately other business intervened so that it was not possible to make visits to the plants as frequently as would have been desirable to test the universality of the occurrence of the phenomena nor has it been possible since to repeat them. But on account of their interest I venture to publish them for what they are worth. I copy the original notes, with only minor changes, from my note book as they were written at the time.

At six o'clock on the evening of July 14, as I was coming across the fields from the experimental farm to Victoria I saw great numbers of *Marsilea vestita* Hook. and Grev. The leaves were still open and in every case turned to face the setting sun in such a manner as to catch the rays perpendicularly. They

were not merely inclined toward the west but were squarely facing in that direction.

At five o'clock the next morning when the day was just dawning they were observed again. The leaves were still tightly folded in their night position. None of them were facing the west as they must have been the night before when they folded up. On the contrary a large proportion of them had turned and were facing the east. But in this respect there was no uniformity in position as there had been in facing west the night before. In the light of the following observation, I interpret this to mean that they were just in process of turning from the west to the east under the influence of the increasing illumination.

At 7:30 on my return from the farm I found that all the leaves were spread out toward the east as they had been to the west the night before. Many thousands were seen and among them all there was not a single exception. The effect was very striking indeed.

The only other opportunity that was offered for observation was a few minutes after two in the afternoon of a cloudy day about an hour after a thunder shower. At that time all of the leaves were spread out parallel to the ground.

I have several times watched other species of Marsilea but have never succeeded in detecting similar movements. It would be most desirable to determine under what special conditions, if any, this phenomenon took place. Perhaps it is a peculiarity of the particular species or variety found at Victoria.

An examination of the leaves to determine in what region the motion took place showed that it was not due to tortion or other movements of the petiole which remained erect and unchanged through the whole process. The motion is rather in the individual leaflets which are turned by the twisting and bending of their petiolules which also cause the folding up of the leaves at nightfall. We have then in these petiolules an exceedingly interesting motile area similar to that found in the Seed Plants.